

CONTROL SYSTEM FOR AGRICULTURAL EQUIPMENT

FIELD OF THE DESCRIPTION

[0001] The present description relates to agricultural equipment. More specifically, the present description relates to a control system for controlling agricultural equipment.

BACKGROUND

[0002] There are many different kinds of agricultural equipment. Some such equipment can include, for instance, harvesters, seeders and planters, tillage equipment, sprayers, to name a few. Such equipment can include sensors that sense a variety of different variables. A control system can generate control signals to control different components or subsystems on the equipment, based upon the sensor signals.

[0003] Such sensor signals often include different kinds of noise. Measurement noise, for instance, can be introduced by the measurement instruments (e.g., the sensors and other measurement components). Process noise can be introduced by variations in the particular variable that is being sensed, where those variations should not impact the control system. In the latter case, it may be that the sensor and corresponding instrumentation is measuring the variable correctly, but the variable has a value that varies, naturally, within a given range, and that variation should not be used to affect the control system.

[0004] The discussion above is merely provided for general background information and is not intended to be used as an aid in determining the scope of the claimed subject matter.

SUMMARY

[0005] In an agricultural machine, sensor signal variability is identified, over a period of time. A control system deadband is identified, based upon the sensor signal variability. A control system uses the control system deadband to control the agricultural machine.

[0006] This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter. The claimed subject matter is not limited to implementations that solve any or all disadvantages noted in the background.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 is a block diagram of one example of a mobile agricultural machine.

[0008] FIG. 2 is a partial pictorial, partial schematic, view of an example where the mobile agricultural machine is a combine.

[0009] FIG. 3 is a flow diagram illustrating one example of the operation of a deadband identifier system in the mobile agricultural machine.

[0010] FIGS. 4-6 show examples of mobile devices that can be used by an operator of the mobile agricultural machine.

[0011] FIG. 7 is a block diagram of one example of a computing environment that can be used in the mobile agricultural machine.

DETAILED DESCRIPTION

[0012] As discussed above, some sensor signals in agricultural machines can have noise components (such as measurement noise and process noise) that result in signal variability. For instance, in some agricultural systems, the signal being measured may be sensed by instrumentation that has its own variability. This noise is referred to as measurement noise. Process noise, on the other hand, results when the sensor is accurately sensing the sensed variable, but the variable itself has some degree of variability. By way of example, in an agricultural machine, it may be that a control system attempts to control an implement so that it is held a given distance off the ground in a field being harvested. It may be that the ground is relatively bumpy. This can cause the sensor signal to fluctuate rapidly, even over short distances traveled, because of the bumps. However, it may not be desirable for the control system to react to each of these variations. Thus, the present system identifies a control deadband that accommodates the signal variability (whether it's from measurement noise or process noise or other sources) and controls the agricultural equipment using that deadband. It should also be noted that the terms "hysteresis" and "deadband" are used herein. In one example, a deadband is a range of a signal input value that does not cause a control output, and hysteresis defines a range of signal input values where the control output is dependent on previous signal values or control output states. Thus, when one term is used herein, it is intended to cover or include the other term as well. Thus, the term deadband is intended to include hysteresis, and vice versa.

[0013] FIG. 1 is a block diagram of one example of an agricultural machine 100. Agricultural machine 100 illustratively includes one or more sensors 102, one or more processors 104, a control system 106, a set of controlled systems or subsystems 108, and a deadband identifier system 110. FIG. 1 also shows that, in one example, machine 100 can include a data store 112, an operator interface 114, and it can include a wide variety of other functionality 116.

[0014] In one example, operator interface 114 includes operator input mechanisms and output mechanisms. The output mechanisms can be mechanisms that can convey information to the operator, such as visual display devices, audio devices, haptic feedback devices, etc. The operator input mechanisms can include a wide variety of different mechanisms that can be actuated by an operator 118 to control and manipulate various systems and subsystems of mobile agricultural machine 100. The operator input mechanisms, for instance, can include levers, steering wheels, pedals, joysticks, buttons, keypads, user input mechanisms on user interface displays, among a wide variety of other input mechanisms.

[0015] In the example shown in FIG. 1, control system 106 illustratively receives sensor signals from sensors 102 and generates control signals to control the various controlled systems or subsystems 108. In addition, deadband identifier system 110 illustratively identifies a deadband associated with each of the sensor signals and provides that deadband to control system 106, so that control system 106 can accommodate various levels of signal variability on the sensor signals generated by sensors 102.

[0016] In one example, deadband identifier system 110 illustratively includes signal characteristic capturing component 120, a clock or timing mechanism 122, control deadband calculation component 124, and it can include